Radial dependency of main phase fluxes in the outer radiation belt relativistic electrons

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Kim and Chan [1997] had studied the large flux decrease of relativistic electrons at geosynchronous orbit during the storm main phase in terms of Dst effect - fully-adiabatic (all three adiabatic invariants conserved) flux changes responding to main phase field perturbations. As a follow-up study, we extended the investigation to main phase fluxes at various L shells covering the outer radiation belt. We calculated equatorially-mirroring relativistic electron fluxes by adiabatically evolving pre-storm fluxes using Liouville's theorem and the conservation of the first and the third adiabatic invariants. It has been observed that main phase flux variationsof outer radiation belt relativistic electrons exhibit a strong radial dependency. The L-dependency can be characterized as (1) a small flux change - either decrease or increase - in the inner edge region of the outer radiation belt (L 2.5 - 3.5) and the strongest decrease at the outer edge of the belt (L 5 - 6). In this work, the calculated fully adiabatic fluxes successfully reproduced the radial pattern of main phase flux variations. In the Dst effect, the radial structure of equatorial magnetic field perturbation $\Delta B(r)$ as we ll as the spatial and energy dependency of quiet-time electron distribution determines a level of flux changes in the outer radiation belt during the main phase. We found that the radial structure of $\Delta B(r)$ yields the largest adiabatic inflation of drift shells (ΔL) near the outer edge and the smallest in the inner edge of the outer belt. Associated with the quiet time electron distribution, it then determines the L value at which the largest flux decrease take place, which locates between the Ls where (ΔL) largest and quiet time flux peaks. The slight increase of main phase fluxe in the inner edge of the belt is attributed to the non-monotonic energy spectrum of quiet time electron model. For some energies in the quiet time electron model, electron fluxes increase with increasing energy, which can yield a flux increase during an adiabatic deceleration process in the storm main phase. Therefore our study presented in this paper suggests that the Dst effect may provide reasonable explanations for the observed radial dependency of main phase flux variations in the outer radiation belt. This further can imply that the Dst effect may be an dominant mechanism that governs the main phase fluxes when there is no strong non-adiabatic process(es) taking a role.